

# UNCLASSIFIED

FY 2001 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 2000

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603217N

PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology

(U) COST: (Dollars in Thousands)  
PROJECT

NUMBER & TITLE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	FY 2002 ESTIMATE	FY 2003 ESTIMATE	FY 2004 ESTIMATE	FY 2005 ESTIMATE	TO COMPLETE	TOTAL ESTIMATE
R0446 Advanced Avionics Subsystems	4,674	3,430	3,493	3,586	3,397	3,373	3,314	CONT.	CONT.
R0447 Weapons Advanced Technology	30,833	26,801	25,249	25,807	26,005	23,680	23,444	CONT.	CONT.
W2014 Integrated High Performance Turbine Engine Technology (IHPTET)	6,946	7,171	6,803	7,534	6,871	6,822	6,716	CONT.	CONT.
R2455 Vectoring Extremely Short Take-off and Landing (ESTOL) Control Reduced Tail Operation Research (VECTOR)	4,832	4,411	4,122	0	0	0	0	0	13,365
R2487 DP-2 Thrust Vectoring System Proof of concept demonstration	1,942	3,978	0	0	0	0	0	0	5,920
R2700 RAMJET Propulsion Technologies	0	2,984	0	0	0	0	0	0	2,984
TOTAL	49,227	48,775	39,667	36,927	36,273	33,875	33,474	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program element (PE) demonstrates concepts for future air platforms and surface/air weapons employed in Naval Warfare. The demonstrated concepts support the Joint Warfare Strategy Forward...from the Sea" and relate to the Joint Mission Areas of Strike, Littoral Warfare, and Intelligence Surveillance and Reconnaissance. Projects in this PE are jointly planned in the Defense Science and Technology Reliance process with the Air Force and Army through panels of the Director Defense Research and Engineering.

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(U) Strike technology issues relevant to this PE include surgical lethality, platform survivability, affordability and increased Naval gunfire range and accuracy. Littoral Warfare technology issues relevant to this PE include air battlespace dominance, expeditionary forces air support, ship self-defense and increased Naval gunfire range and accuracy. Intelligence Surveillance and Reconnaissance technology issues relevant to this PE include platform mission endurance and survivability. Seven projects are executed within the PE:

(U) Advanced Avionics Subsystems (AAS): The AAS program has as its goal the demonstration in real-time on an embedded avionics processor of an annotated, geo-referenced, 3D perspective out-the-window scene of the terrain and target/threat environment external to the aircraft. The program will provide the following functional capabilities: a) the ability to perform in-flight mission preview; b) the ability to ingest, view and obtain precision targeting solutions from off-board sensor image updates; c) the ability to perform in-flight mission replanning; and d) the ability to share a Common Tactical Picture among multiple platforms

(U) Weapons Advanced Technology: Demonstrates emerging sub-system/component level weapons concepts which promise affordable and significant performance improvements to both existing and next generation Naval Air and Surface launched weapons. These efforts in this area will demonstrate the achievement of the time-phased Air and Surface Weapons Technology (ASWT) goals, which will maintain and increase the Naval Air and Surface Weapons capability edge through the 21<sup>st</sup> century.

(U) Integrated High Performance Turbine Engine Technology (IHPTET): Provides experimental engine testing of new gas turbine engine technologies to demonstrate readiness and reduce technical risk for entering engineering development. IHPTET is a Tri-Service program in which each Service contributes established shares of 6.2 and 6.3 funding and laboratory resources to meet specified goals of doubling thrust-to-weight ratio, halving fuel consumption by the year 2003 (relative to a 1987 baseline) and reducing acquisition and maintenance costs. Additional emphasis has been incorporated to address High Cycle Fatigue issues, which may be associated with propulsion system design system deficiencies.

(U) Vectoring ESTOL Control Reduced Tail Operation Research (VECTOR) Program: An international cooperative program with Germany. VECTOR will utilize the X-31 aircraft to develop, flight demonstrate, provide quality metrics and operational concept formulation and validation of ESTOL and supporting thrust vectoring technologies. The program will also develop an

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Advanced Air Data System (AADS) (specifically and uniquely designed to operate even at extreme angles of attack) and will explore reduced vertical tail/directional controls.

(U) The DP2 Thrust Vectoring System: A this program is a demonstration of a proof-of-concept of a reduced-scale flight test vehicle. The vehicle concept is a vertical take-off and landing (VTOL) aircraft of advanced composite construction, utilizing thrust vector control.

(U) The Navy Science and Technology (S&T) program includes projects that focus on or have attributes that enhance the affordability of warfighting systems.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED TECHNOLOGY DEVELOPMENT Budget Activity because it encompasses design, development, simulation, experimental testing or prototype hardware. It is also necessary to validate technological feasibility and concept of operations to reduce technological risk prior to initiation of a new acquisition program or transition to an ongoing acquisition program.

## B. (U) PROGRAM CHANGE SUMMARY FOR TOTAL P.E.:

	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>
FY 2000 President's Budget	47,398	42,046	37,969
Appropriated Value	-	49,046	-
Adjustments from FY 2000 PRESBUDG:			
SBIR/STTR Transfer	-607	0	0
Execution Adjustment	2,654	0	0
Program Adjustment	0	0	1,971
Inflation Rate Adjustment	-218	0	0
Various Rate Adjustments	0	0	-291

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Congressional Rescissions	0	-271	0
Mil/Civ Pay Rates	0	0	18
Congressional Adds			
DP-2 Thrust Vectoring	0	4,000	0
RAMJET Propulsion	0	3,000	0
FY 2001 President's Budget	49,277	48,775	39,667

(U) CHANGE SUMMARY EXPLANATION:

(U) Schedule: Not Applicable.

(U) Technical: Not Applicable.

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(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1999 ACTUAL	FY 2000 ESTIMATE	FY 2001 ESTIMATE	FY 2002 ESTIMATE	FY 2003 ESTIMATE	FY 2004 ESTIMATE	FY 2005 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
0446 Advanced Avionics Subsystems (AAS)	4,674	3,430	3,493	3,586	3,397	3,373	3,314	CONT.	CONT.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project demonstrates commercial-off-the-shelf (COTS) technology systems that will facilitate the introduction of new functionality (e.g., 3 dimensional (3-D) perspective scene visualization, pilot/crew workload reduction, on/off-board sensor data fusion, mission replanning, etc.) into existing Navy aircraft and future platforms in a cost-effective manner. The project includes: (a) Advanced Visualization and Data Fusion Software (AVDFS); (b) scalable open architecture project (SOAP); (c) advanced interconnect technology; and (d) the design and build of an Advanced Mission Computer and Display (AMC&D)-like processor. Individual performers and tasks are selected to maximize the probability of transfer of successful results to Navy and other systems. This project addresses the Joint Vision 2010, Navy Science and Technology (S&T) Requirements Guidance, ...Forward From The Sea, and the outyear plans of several naval aviation programs (e.g., F/A-18, Air Combat Electronics, Tactical Aircraft Mission Planning, AV-8B, Joint Strike Fighter (JSF) and others). Key objectives include providing better technology transparency, reducing software costs, opening currently closed avionics architectures, protocol-independent high-speed/high-bandwidth databases, and ability to introduce new functionality for effective joint warfighting.

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PROGRAM ELEMENT: 0603217N

PROGRAM ELEMENT TITLE: Air Systems and  
Weapons Advanced Technology

PROJECT NUMBER: R0446

PROJECT TITLE: Advanced Avionics  
Subsystems (AAS)

## A. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

### 1. (U) FY 1999 ACCOMPLISHMENTS:

(U) Initiated:

- (U) Developed a baseline capability to incorporate and display infrared sensor imagery with AVDFS 3-D visualization software.
- (U) Integrate AVDFS with the Tactical Aircraft Mission Planning System (TAMPS) and Joint Mission Planning Segment (JMPS) mission planning systems to provide mission rehearsal and preview capability. Prototype versions of AVDFS were used to support Operation Allied Force.
- (U) Initial investigations on high efficiency interface protocols to improve network bandwidth efficiency.
- (U) Implementation of 3-D perspective scene generation into embedded hardware architecturally consistent with AMC&D technology insertion Architecture.
- (U) Initial software portability across processors, operating systems network types and object request brokers.

(U) Continued:

- (U) To develop the capability to execute 3-D perspective scene generation software in real-time on embedded avionics hardware. The development methodology will involve the iterative use of software simulation techniques in conjunction with the progressive use of proposed Advanced Mission Computer and Display (AMC&D) hardware.
- (U) Geo-registered image mosaicing techniques and data compression technology required to fuse imagery from multiple sources and bring in information from off-board.
- (U) Refining image generation software for portability to multiple commercial-off-the-shelf (COTS) graphics engines. Migration of AVDFS to multiple platforms including the entire Silicon Graphics Inc. (SGI) product line and Windows New Technology (NT) INTEL-based processors.
- (U) Performance analysis and development of Common Object Request Broker Architecture (CORBA) in a real-time deterministic system.
- (U) Performance analysis and development of CORBA in a real-time deterministic system.

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Weapons Advanced Technology

PROJECT NUMBER: R0446

PROJECT TITLE: Advanced Avionics  
Subsystems (AAS)

- (U) Incorporation of Real-time Database Management System.
- (U) Definition of network requirements and capabilities for an information intensive unified system

(U) Completed:

- (U) Demonstration showing the revised AVDFS software (called PowerScene II) to: 1) Execute across multiple platforms (SGI/IRIX, PC/WindowsNT, PC/Windows 98, SUN/Solaris); and 2) incorporate/exploit image and terrain databases from the National Imagery and Mapping Agency (NIMA).
- (U) Integration of AVDFS with TAMPS 6.2 mission planning software.
- (U) Demo which shows a baseline capability to incorporate and display infrared (IR) sensor imagery with AVDFS 3-D visualization software.
- (U) Integration of signal processing node into the SOAP architecture based on COTS technology.
- (U) Investigation of using processing resources on the Optical Backplane Interconnect System (OBIS) backplane as the embedded resource for visualization algorithms.
- (U) Fault tolerant/dynamic reconfiguration in a Real-time CORBA environment.
- (U) Performance modeling process development to be used throughout project life.

- (U) Advanced Avionics Interconnect Technology

(U) Continued:

- (U) Development of extremely high-speed and high-bandwidth protocol independent optical data network based on COTS technologies and techniques. Technology leverages fiber optic technologies developed by the commercial telecommunications industry. This effort seeks to replace the current MIL-STD-1553 bus technology.
- (U) Evaluation of optical interconnect components for ships and aircraft under joint Naval Sea Systems Command (NAVSEA)/Naval Air Systems Command (NAVAIR) Dual-Use Science and Technology (S&T) project agreement.
- (U) Integration of key components for High Speed Optical Networks.

3. (U) FY 2000 PLAN:

(U) Initiate:

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Weapons Advanced Technology

PROJECT NUMBER: R0446

PROJECT TITLE: Advanced Avionics  
Subsystems (AAS)

- (U) Development of the baseline capability to execute AVDFS software in near real-time on the Navy's next generation embedded mission computer - AMC&D (target AMC&D build 2).
- (U) Definition and development of AVDFS functionality to showcase the ability to perform a Time Critical Strike (TCS) mission scenario in conjunction with real-time execution on AMC&D.

(U) Continue:

- (U) Development and demonstration of interoperability with operational avionics hardware.
- (U) Development of the capability to execute 3-D perspective scene generation software in real-time on embedded avionics hardware.
- (U) Geo-registered image mosaicing techniques and data compression technology (required to fuse imagery from multiple sources and bring in information from off-board)
- (U) Real-time CORBA evaluation
- (U) Evaluation of high efficiency interconnect protocols.

(U) Complete:

- (U) Off-board interface definition.
- (U) Performance analysis and development of CORBA in a real-time deterministic system
- (U) Real-time Database Management System and Mass Memory trade study.
- (U) Definition of network requirements and capabilities for an information intensive unified system.
- (U) System design for FY 2001 demonstration hardware and software architectures.
- (U) Prototype pilot interface for visualization software.

1. (U) FY 2001 PLAN:

(U) Complete:

- (U) Demonstration showing the capability to execute AVDFS software in real-time on the Navy's next generation embedded mission computer - AMC&D processor.

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PROJECT NUMBER: R0446

PROJECT TITLE: Advanced Avionics  
Subsystems (AAS)

- (U) Demonstration showing the tactical utility of AVDFS in performing a TCS mission scenario in conjunction with real-time execution on AMC&D.
- (U) Hardware, operating system prototype based on AMC&D hardware. Prototype may require supplemental processing elements for some image fusion computations.
- (U) 3-D visualization in embedded hardware.
- (U) Integration into demonstration environment.
- (U) Characterization of system performance and transition into engineering, manufacturing and development (EM&D) products.

3. (U) PROGRAM CHANGE SUMMARY: See total program change summary for P.E.

4. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E: This program adheres to Defense Reliance Agreements for Sensors, Electronics and Battlespace Environment (Integrated Platform Electronics).

(U) Work in this Program Element (PE) is related to and fully coordinated with efforts in the following PEs:

- (U) PE 0601152N (In-House Lab Independent Research)
- (U) PE 0601153N (Defense Research Sciences)
- (U) PE 0602111N (Air and Surface Launched Weapons Technology)
- (U) PE 0602122N (Aircraft Technology)
- (U) PE 0602202F (Human Systems Technology)
- (U) PE 0602204F (Aerospace Avionics)
- (U) PE 0602234N (Materials, Electronic and Computer Technology)
- (U) PE 0602708E (Cockpit Autonomous Landing)
- (U) PE 0603231F (Crew Systems and Personnel)
- (U) PE 0603238N (Precision Strike and Air Defense Technology)

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PROJECT TITLE: Advanced Avionics  
Subsystems (AAS)

(U) PE 0603792N & 0603792F (Advanced Technology Demonstrations)  
(U) PE 0603800N & 0603800F (Joint Strike Fighter (JSF) DEM/VAL)  
(U) PE 0603253F (Advanced Avionics Integration)

3. (U) SCHEDULE PROFILE: Not applicable.

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PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	FY 2002 ESTIMATE	FY 2003 ESTIMATE	FY 2004 ESTIMATE	FY 2005 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
0447 Weapons Advanced Technology	30,833	26,801	25,249	25,807	26,005	23,680	23,444	CONT.	CONT.

1. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project will reduce technical risk by performing technology demonstrations in guidance and control, ordnance, Guns and Launchers, fire control air breathing propulsion and airframe aeromechanics sub-system/component concepts. It builds on the foundation of research emerging from Navy and Industry Applied Research projects funded by PE 0602111N programs which promise affordable performance improvements to existing next generation Naval air and surface launched weapons. The elements of the project address Joint Mission Area (JMA) requirements for increased capabilities in surgical lethality of weaponry (Strike JMA), increased ship self defense capabilities (Littoral Warfare JMA) and increased accuracy and range for Naval Surface Fire Support (Strike and Littoral JMAS).

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BUDGET ACTIVITY: PROGRAM ELEMENT: 0603217N  
PROGRAM ELEMENT TITLE: Air Systems and PROJECT NUMBER: R0447  
Weapons Advanced Technology PROJECT TITLE: Weapons Advanced Technology

## (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

### 1. (U) FY 1999 ACCOMPLISHMENTS:

- (U) Cruise Missile Real Time Retargeting Demonstration (CMRTR):
  - (U) Demonstrated the Build 1 Laser Detecting and Ranging Seeker (LADAR) in the lab which includes the adaptive strike planning and fixed/mobile target automatic target recognition software, and Tomahawk 6 DOF simulation.
  - (U) Finished modification of the T-39 test aircraft to accept the Build 1 LADAR sensor. This task included design and fabrication of the mechanical/electrical interface assemblies, wiring harnesses, and interface boards to the lab.
  - (U) Conducted successful Flight testing of the Build 1 solid state LADAR on the T-39 aircraft. 17 out of 17 successful runs with automatic target recognition (ATR) functioning correctly. Operated multiple successful LADAR targeting runs against urban targets in conjunction with Marine Corps training in Yuma Arizona.
  - (U) Continued fabrication of Build 2 sensor for delivery in FY 2000.
  - (U) Modified the T-39 test aircraft to accept the Build 2 LADAR sensor. This task includes designing and fabricating the mechanical/electrical interface assemblies, wiring harnesses, and interface boards to the lab.
- (U) Surgical Strike Adaptive Video Control and Data Communication System:
  - (U) This task develops and demonstrates advanced video compression and Radio Frequency (RF) modulation/coding technology for a podless digital weapon control data link system for use in joint strike operations
  - (U) Began flight test planning for FY 2000 system verification and testing.
  - (U) Integrated terminals into ground test platforms.
  - (U) Ground tested multiple terminals.
  - (U) Integrated terminals into flight test platforms.
  - (U) Refined system level performance requirements.
  - (U) Continued Performance prediction analysis of weapon control data link system.
  - (U) Performed laboratory integration testing of terminals.

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   Weapons Advanced Technology      PROJECT TITLE:    Weapons Advanced Technology

- (U) Finished design, development, and fabrication of RF, modem, network control, processor, and central processor submodules.
- (U) Completed platform integration approach/design.
- (U) Defined electrical and mechanical terminal interfaces.
- (U) Concentric Canister Launcher (CCL):
  - (U) Continued Tomahawk Computational Fluid Dynamics (CFD) model validation.
  - (U) Proceeded with hatch design and fabrication.
  - (U) Maintained efforts for fabrication of prototype launch system hardware.
  - (U) Continued design and fabrication of canister interface electronics unit.
  - (U) Completed demonstration of all up distributed control system.
  - (U) Continued development of fiber optical Local Area Network (LAN) architecture.
  - (U) Conducted SM2 Blk IV restrained firing.
  - (U) Conducted Tomahawk Land Attack Missile (TLAM) Land/Sea flyout test via LAN and CCL electronics.
  - (U) Conducted Evolve Seasparrow Missile (ESSM) and decoy electronic development.
- (U) Concurrently Engineered (CE) Ball-Joint Gimbal for Joint Strike Weapon:
  - (U) Started CE seeker flight tests and demonstration.
  - (U) Conducted CE seeker integration and test, ground, rooftop, Hardware In The Loop (HITL) tests.
  - (U) Finished integration of CE gimbal hardware and flight test pod.
  - (U) Completed ground, rooftop, HITL, flight tests, and program documentation.
- (U) Shared Aperture: This task enables the development and demonstration of wideband multifunction RF systems with shared apertures and electronics to perform the functions currently performed by multiple RF systems, in particular radar, communications and Electronic Warfare (EW) systems.
  - (U) Constructed test prototype.
  - (U) Finished final design for open architecture multifunction RF system.

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Weapons Advanced Technology

PROJECT NUMBER: R0447

PROJECT TITLE: Weapons Advanced Technology

- (U) High Speed Missile Technology (Formerly Hypersonics): This task will demonstrate airframe propulsion guidance & control and ordnance technologies of the dual combustion ramjet for potential next generation Navy high speed strike missiles.
  - (U) Began initial design of dual combustion ramjet test vehicle.
  - (U) Developed test plan for free jet testing of the ramjet.
  - (U) Developed preliminary design of the test stand.
- (U) Land Attack and Deep Strike (LADS) Weapon Technology: This task will demonstrate the capability to substantially improve the mission planning and execution times for land attack and deep strike missions for both surface and submarine launched tactical strike weapons such as Tactical Tomahawk, Fasthawk, Navy Tactical Missile System (NTACMS), and the Land Attack Standard Missile (LASM). The demonstration uses the following technology developed in the 6.2 Weapons program (PE 0602111N): Weapon/target pairing, Bomb Damage Identification (BDI) from Synthetic Aperture Radar (SAR) processing, Global Positioning System (GPS)/Inertial Measurement Unit (IMU) attitude accuracy for 3 dimensional (3-D) precision targeting, algorithms for rapid Tomahawk mission planning, and rapid tactical area mapping.
  - (U) Defined preliminary operational concept for the LADS weapon demonstration
  - (U) Produced an initial top level architecture for the mission planning system
  - (U) Identified components of the previous 6.2 program products that will be transitioned to the LADS weapon demonstration.
  - (U) Reviewed software and hardware components of 6.2 elements (e.g. GPS/IMU, BDI SAR, etc) transitioning to the LADS demonstration. Identify the modifications required to integrate the components into the demonstration.
- (U) Integrated High Payoff Rocket Propulsion Technology (IHRPRT): This task will demonstrate high kinetic performance air launched rocket motor technologies. These technologies will be integrated into a 5'-8' diameter flight weight rocket motor and demonstrated in ground tracking. Technologies demonstrated will include

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   Weapons Advanced Technology      PROJECT TITLE:    Weapons Advanced Technology

aluminized and non-aluminized reduced smoke propellants; light weight, high strength/stiffness component case; high pressure combustion; thrust vector control (TVC)(integrated aero/TVC and aft mounted jet reaction control); and a light weight, low erosion nozzle.

- (U) Optimized reduced smoke solid propellant grain geometry and burn rate characteristics.
- (U) Conducted static firing of subscale rocket motors at increasing chamber pressures to verify propellant specific impulse.
- (U) Analytically evaluated composite case strength.

- (U) Precision Strike Navigator (PSN):
  - (U) Continued test preparation and integration.
  - (U) Continued Inertial Measurement Unit (IMU) fabrication.
  - (U) Completed wafer material & structure development and characterization.
  - (U) Continued wafer fabrication

3. (U) FY 2000 Plan:

- (U) CMRTR:
  - (U) Complete flight testing of Build 1 LADAR
  - (U) Finish development of critical mobile target algorithm.
  - (U) Conduct synthetic scene generation work for hardware in the loop testing.
  - (U) Demonstrate adaptive strike planner executive allocator.
  - (U) Conduct ground test of Build 2 LADAR
  - (U) Begin flight testing of Build 2 LADAR
- (U) Surgical Strike Adaptive Video Control and Data Communication System:
  - (U) Finish F/A-18 system integration studies.

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- (U) Complete Flight testing of Surgical Strike system. Demonstrate real time video and high bandwidth capacity in F/A-18 flight test aircraft.

- (U) CCL:
  - (U) Complete Standard Missile II, Block IV restrained firing test.
  - (U) Finish CCL conceptual design for ship integration
  - (U) Conclude CCL life cycle cost study.
  - (U) Performed integration/testing of TLAM, SM-2, Torpedo, and complex node electronics.
  - (U) Produce final report.
- (U) High Speed Missile Technology
  - (U) Perform component and subsystem integration for dual combustion ramjet propulsion system testing
  - (U) Fabricate test stand for free jet testing
  - (U) Conduct subsystem verification testing for dual combustion ramjet free jet testing
  - (U) Develop final design of dual combustion ramjet test vehicle.
- (U) LADS weapon demonstration:
  - (U) Develop a detailed architecture and system design for the mission planning system configuration
  - (U) Define the interface requirements between the software interfaces of the rapid mission planning, tactical area mapping, and weapon/target pairing components.
  - (U) Test the coupled GPS/IMU attitude accuracy for 3-D precision targeting
  - (U) Begin implementation of planning system in testbed.
  - (U) Demonstrate an affordable strike weapon seeker and data link system in a captive carry flight test.
- (U) Ship Based Defense Demonstration: This task will demonstrate the technologies for increasing the effectiveness of ship based defense systems in tracking and killing supersonic, maneuvering cruise missiles. The task builds on the following PE 0602111N tasks: interactive adaptation of fire control to the environment,

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DATE: February 2000

BUDGET ACTIVITY: PROGRAM ELEMENT: 0603217N  
PROGRAM ELEMENT TITLE: Air Systems and PROJECT NUMBER: R0447  
Weapons Advanced Technology PROJECT TITLE: Weapons Advanced Technology

Non-Uniformity Compensated Focal Plane Array (NUCFPA), and clutter processing. Three technology demonstrations will be comprised of two components. The adaptive weapon control demonstration will demonstrate the feasibility of increasing weapon performance by improving the ability of the weapon to adapt to changing propagation environments. The other component will improve the performance of the weapon warhead against maneuvering targets by implementing alternative warhead concepts.

- (U) Evaluate and analyze the effectiveness of two alternative warhead designs, the reactive material warhead and the miniature aimed warhead. These warhead designs were developed in the PE 0602111N Air and Surface Weapons Technology (ASWT) program. A down select will be made to select the best alternative for a kill mechanism against a maneuvering threat.

- (U) Conduct weapon system integration study of shipboard electro-Optic (EO) trackers, weapons control systems, and miniature command/link receivers. This will result in a down select between command guidance and command waypoint guidance.

- (U) IHRPT:
  - (U) Develop high strength, light weight, high pressure composite case rocket motor
  - (U) Develop and test low/no erosion nozzle throat insert materials and test to determine suitability
  - (U) Static test subscale low erosion nozzles at high pressure to determine erosion characteristics
- (U) PSN:
  - (U) Complete wafer fabrication
  - (U) Complete IMU fabrication and testing.
  - (U) Document results of demonstration
- (U) Advanced Common Electronic Modules (ACEMs):
  - (U) Complete:
    - (U) Development and testing of ACEMs that will be smaller, and have less power consumption and higher performance than their analog counterparts, while accomplishing all the requisite acquisition, transmission and

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PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology PROJECT NUMBER: R0447  
PROJECT TITLE: Weapons Advanced Technology

digital processing of Radio Frequency (RF) signals over a very wide frequency range (50 MHz to 45GHz). The family of ACEMs consists of advanced analog-to-digital technology and will be integrated to create systems capable of performing multiple functions. This enhances affordability through a 10-fold projected decrease in systems weight and power consumption, a 15-fold increase in systems performance, and substantial Life Cycle Cost savings. This program and technology transitioned from PE 0602122N at the end of FY99.

(U) FY 2001 Plan:

- (U) CMRTR:
  - (U) Conduct flight testing of Build 2 LADAR using T-39 test aircraft.
  - (U) Test and verify in flight the performance of the Automatic Target Recognition (ATR) capability of the CMRTR system,
  - (U) Complete effort by conducting flight test and demonstration of the Adaptive Strike Planning and auto routing capabilities of the CMRTR system.
- (U) High Speed Missile Technology
  - (U) Begin advanced airframe testing activities to evaluate performance of different design alternatives in the Mach 4+ environment.
  - (U) Conduct component and subsystem integration of advanced airframe design components.
  - (U) Test the ordnance operation and performance in the Mach 6+ environment. Evaluate and test multiple ordnance configurations such as Unitary warheads, kinetic penetrator structures, and multiple submunition configurations.
  - (U) Develop Safe-arm and fuzing technologies that are effective at the terminal speeds of a high speed missile.
- (U) LADS strike weapon demonstration
  - (U) Finalize design of mission planning system

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PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology PROJECT NUMBER: R0447  
PROJECT TITLE: Weapons Advanced Technology

- (U) Initiate modifications required to integrate the components into the LADS demonstration (i.e. the development of enhanced mission planning capability and open systems avionics architecture for "smart" loitering weapon system.).
- (U) Incorporate and test algorithms for responsive Tactical Tomahawk loiter/retargeting planning into testbed.
- (U) Modify tactical area mapping and BDI assessment components to interface with the mission planning components. Test and refine interfaces between mapping and BDI elements.
- (U) Provide a preliminary design for fire control applications for additional strike weapons such as Fasthawk and Land Attack Standard Missile (LASM).
- (U) Refine and test Tacair targeting capability.
- (U) Conduct a flight demonstration of an affordable strike weapon carrying a seeker and Data Link system.
- (U) Ship Based Defense Demonstration:
  - (U) Evaluate the integration interaction of shipboard meteorological sensors with weapon control components and weapon doctrine systems. Define rules for radar sensitivity variations in different propagation environments and identify and optimize AM/SPY-1 Sensitivity Time Control (STC) notch setting for maximum performance in a wide range of propagation environments. Begin preliminary design of a decision aide to assist operator in adapting radar sensitivity settings for optimum performance based on a changing propagation environment.
  - (U) Using warhead configuration selected in prior year, design and build a prototype warhead that provides a significantly improved kill capabilities against the maneuvering cruise missile threat and can be adapted to current self defense missile systems.
  - (U) Design and prototype the airframe control components that are necessary to provide the endgame maneuverability for a higher probability of kill (Pk) against the maneuvering threat.
- (U) Multi-Target Air-to-Air Missile Demonstration: This project will demonstrate an inexpensive RF seeker that can locate and track multiple targets in an air-to-air engagement involving a lead aircraft, his wingman, and an enemy aircraft. The RF seeker will be conformal (i.e. mounted on the missile body) thereby freeing up the nose section of the missile to accommodate a second seeker. The second seeker can be configured to provide a higher

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PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology PROJECT NUMBER: R0447  
PROJECT TITLE: Weapons Advanced Technology

level of precision tracking in the end game of the missile engagement and thereby significantly increasing missile Pk and improving the exchange ratio in the post merge air to air engagement. This demonstration transitions the ASWT Surface Wave Antenna advanced seeker project in PE 0602111N.

- (U) Develop detailed seeker performance requirements
- (U) Modify processor design and algorithm to support greater RF angular precision
- (U) Develop preliminary seeker transmitter/receiver packaging and commercial off the shelf (COTS) electronic design.

- (U) IHRPT Technology:
  - (U) Evaluate high performance/low loss thrust vector control concepts for air launch
  - (U) Downselect to the most promising thrust vector control concept and static fire at low pressure.
  - (U) Combine propellant, case, nozzle, and case technology into full scale (7''-8''diameter) motor. Static fire the motor to determine the performance characteristics.
- (U) Shape Memory Alloy (SMA) Actuator: This effort will demonstrate the proof of concept for a reconfigurable rotor system that can be applied to improve range and weapon carrying capacity forUCAVs during precision strike and close air support operations. This program will build upon prior sub-scale, shape memory alloy technology efforts sponsored by Defense Advanced Research Projects Agency (DARPA).
  - (U) Refinement and re-scaling of a sub-scale actuator design concept.
  - (U) Integration of a large scale, shape memory alloy actuator into the rotor blade of a test aircraft.

3. (U) PROGRAM CHANGE SUMMARY: See total program change summary for P.E.

2. (U) OTHER PROGRAM FUNDING SUMMARY: Not Applicable

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DATE: February 2000

BUDGET ACTIVITY: PROGRAM ELEMENT: 0603217N  
PROGRAM ELEMENT TITLE: Air Systems and PROJECT NUMBER: R0447  
Weapons Advanced Technology PROJECT TITLE: Weapons Advanced Technology

(U) RELATED RDT&E:

- (U) PE 0601152N (In House Lab Independent Research)
- (U) PE 0601153N (Defense Research Sciences)
- (U) PE 0602111N (Air and Surface Launched Weapons Technology)
- (U) PE 0602122N (Aircraft Technology)
- (U) PE 0602234N (Materials, Electronic, and Computer Technology)
- (U) PE 0602602F (Conventional Munitions)
- (U) PE 0603238N (Precision Strike and Air Defense Technology)
- (U) PE 0603609N (Conventional Munitions)
- (U) PE 0603601F (Advanced Weapons)
- (U) PE 0207133F (F-16 Squadrons)
- (U) PE 0203730A (Chaparral Missile)

3. (U) SCHEDULE PROFILE: Not applicable.

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FY 2001 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 2000

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603217N

PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	FY 2002 ESTIMATE	FY 2003 ESTIMATE	FY 2004 ESTIMATE	FY 2005 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
2014 Integrated High Performance Turbine Engine Technology (IHPTET)	6,946	7,171	6,803	7,534	6,871	6,822	6,716	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project covers the Navy's share of the demonstrator engine efforts under the Department of Defense (DoD)/National Aeronautics and Space Administration (NASA) Industry IHPTET program ensuring that Navy unique design and operational requirements are met. Full scale integrated technology demonstration is essential to validate and transition technologies from applied research through advanced development and into system demonstration/validation, engineering and manufacturing development or product lines. Without technology demonstrators system acquisition cost and schedule risk would increase to unacceptable levels or weapons systems would have degraded operational performance. The lack of technology demonstrator efforts could result in system development schedule increase of five or more years along with the associated increase in cost. The technology sets integrated into and demonstrated in the IHPTET demonstrator engines are closely related to the system requirements for the Joint Strike Fighter (JSF), F-18E/F Common Support Aircraft (CSA), Multi-mission Maritime Aircraft (MMA), Tactical Tomahawk, SH-60R, and other future Navy platforms, so that the transition of these high risk and high payback technologies may be effectively accomplished. In addition, IHPTET technologies can transition to current legacy systems via engine Component Improvement Programs (CIP). This strong and viable U.S. propulsion program also provides a dual-use benefit to our country by enhancing our competitiveness in the international commercial engine market. This long term project, coordinated through Reliance, will provide for the future needs in air battlespace dominance and expeditionary forces support (Littoral Warfare Joint Mission Area (JMA))

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DATE: February 2000

BUDGET ACTIVITY: 3      PROGRAM ELEMENT: 0603217N  
PROGRAM ELEMENT TITLE: Air Systems and      PROJECT NUMBER: W2014  
Weapons Advanced Technology      PROJECT TITLE: Integrated High Performance  
Turbine Engine Technology

Increased platform mission endurance (Intelligence, Surveillance, and Reconnaissance JMA) and provide technology for increased affordability and platform survivability and increased mission effectiveness (Strike JMA). The program funds three demonstrator engine classes. Each engine class has specific performance goals that are divided into multiple phases. Phase I has been completed and demonstrated for each of the three classes of demonstrators. Phase II is currently progressing to the engine demonstration phase, for all of the advanced component technologies, in the current fiscal year. The Phase III concepts were developed and have been initiated. The phase goals of each engine class are listed as follows and are referenced to a 1987 baseline (additional affordability goals have been developed for fighter/attack and turboprop/shaft classes):

- (U) Fighter/attack (Joint Technology Demonstrator Engine (JTDE)):  
Phase I - 1991: +30% thrust/weight (Fn/Wt), +100 °F combustor inlet temperature (CIT), +300 °F turbine inlet temperature (TIT), -20% fuel burn.  
Phase II - 1997: +60% Fn/Wt, +200 °F CIT, +600 °F TIT, -20% acquisition cost, -20% maintenance cost, -30% fuel burn.  
Phase III - 2003: +100% Fn/Wt, +400 °F CIT, +900 °F TIT, -35% acquisition cost, -35% maintenance cost, -40% fuel burn.
- (U) Turboprop/shaft (Joint Turbine Advanced Gas Generator (JTAGG)):  
Phase I - 1991: +40% shaft horsepower/weight (SHP/Wt), -20% specific fuel consumption (SFC), +300 °F TIT.  
Phase II - 1997: +80% SHP/Wt, -30% SFC, +600 °F TIT, -20% acquisition cost, -20% maintenance cost.  
Phase III - 2003: +120% SHP/Wt, -40% SFC, +1000 °F TIT, -35% acquisition cost, -35% maintenance cost.
- (U) Missile/expendable engines (Joint Expendable Turbine Engine Concepts (JETEC)):  
Phase I - 1991: +35% thrust/airflow (Fn/Wa), -20% SFC, +1100 °F CIT, +500 °F TIT, -30% Cost.  
Phase II - 1997: +70% Fn/Wt, -30% SFC, +1200 °F CIT, +900 °F TIT, -45% Cost.  
(U) Phase III - 2003: +100% Fn/Wa, -40% SFC, +1400 °F CIT, +1400 °F TIT, -60% Cost.

(U) Each engine company (Allison Advanced Development Company (AADC) (IN) Honeywell International Engines and Systems (formerly AlliedSignal Engines) (AZ), General Electric (GE) (OH & MA), Pratt & Whitney (P&W) (CT & FL), Teledyne Continental Motors Engine Division (formerly Teledyne Ryan Aeronautical) (OH) and Williams International (WI) (MI)) attempts to utilize at least two engine builds or demonstrator tests within each Phase to demonstrate the performance

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BUDGET ACTIVITY: 3      PROGRAM ELEMENT: 0603217N  
PROGRAM ELEMENT TITLE: Air Systems and      PROJECT NUMBER: W2014  
Weapons Advanced Technology      PROJECT TITLE: Integrated High Performance  
Turbine Engine Technology

goals. The JETEC goals are divided into demonstrating SFC and Cost for a subsonic demonstrator and Fn/Wa, CIT, TIT and Cost for a supersonic demonstrator.

## (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

### 1. (U) FY 1999 ACCOMPLISHMENTS:

- (U) Continued:
  - (U) Phase II JTDE: Completed Pratt & Whitney (P&W) Phase II demonstrator engine testing, achieving +41%Fn/Wt (XTE66/1).
  - (U) Phase II JTAGG: Completed fabrication, assembly and instrumentation of initial Honeywell (formerlyAllied Signal Engines (ASE) demonstrator engine.
  - (U) Phase II JETEC: Completed assembly and instrumentation of both Williams International (WI) and Allison Advanced Development Company (AADC) supersonic demonstrator engines.
  - (U) Phase III JTDE: Completed source selections with P&W and General Electric (GE/AADC) and initiated designs.
  - (U) Phase III JTAGG: Initiated design of (GE/AADC) demonstrator engine.
  - (U) Phase III JETEC: Completed source selection with WI and initiated design. Continued design and fabrication of ASE demonstrator engine.

### 2. (U) FY 2000 PLAN:

- (U) Continue:
  - (U) Phase II JTDE: Complete fabrication, assembly, and instrumentation of AADC demonstrator engine
  - (U) Phase II JTAGG: Initial demonstrator engine test. Component optimization and second build of demonstrator engine to meet Phase II goals
  - (U) Phase II JETEC: Complete demonstrator engine test at WI and AADC to achieve Fn/Wa and cost goals.
  - (U) Phase III JTDE: Design of Phase III demonstrator engines
  - (U) Phase III JTAGG: Design of Phase III demonstrator engines

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DATE: February 2000

BUDGET ACTIVITY: 3      PROGRAM ELEMENT: 0603217N  
PROGRAM ELEMENT TITLE: Air Systems and      PROJECT NUMBER: W2014  
Weapons Advanced Technology      PROJECT TITLE: Integrated High Performance  
Turbine Engine Technology

- (U) Phase III JETEC: Design and fabrication of Phase III demonstrator engines

3. (U) FY 2001 PLAN:

- (U) Continue:
  - (U) Phase II JTDE: Demonstration of Phase II goals with GE/AADC demonstration engine.
  - (U) Phase II JTAGG: Demonstration of Phase II goals with Honeywell demonstration engine.
  - (U) Phase III JTDE: Fabrication, assembly and instrumentation of GE/AADC and P&W demonstrator engines and demonstration of Pratt & Whitney progress toward Phase III goals.
  - (U) Phase III JTAGG: Design, component development and fabrication of demonstrator to meet Phase III goals.
  - (U) Phase III JETEC: Design, component development and fabrication of demonstrator engines to meet Phase III goals.

3. (U) PROGRAM CHANGE SUMMARY: See total program change summary for P.E.

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

2. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:

- (U) PE 0601152N (In-House Lab Independent Research)
- (U) PE 0601153N (Defense Research Sciences)
- (U) PE 0601102F (Defense Research Sciences)
- (U) PE 0601102A (Defense Research Sciences)
- (U) PE 0602122N (Aircraft Technology)
- (U) PE 0602234N (Materials, Electronic and Computer Technology)
- (U) PE 0602203F (Aerospace Propulsion)
- (U) PE 0602211A (Aviation Technology)
- (U) PE 0603202F (Aircraft Propulsion Subsystem Integration)

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DATE: February 2000

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603217N

PROGRAM ELEMENT TITLE: Air Systems and  
Weapons Advanced Technology

PROJECT NUMBER: W2014

PROJECT TITLE: Integrated High Performance  
Turbine Engine Technology

(U) PE 0603216F (Advanced Turbine Engine Gas Generator)

(U) PE 0603003A (Aviation Advanced Technology)

3. (U) SCHEDULE PROFILE: Not applicable.

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DATE: February 2000

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603217N

PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology

(U) COSTS: (Dollars in Thousands)

PROJECT

NUMBER & TITLE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	FY 2002 ESTIMATE	FY 2003 ESTIMATE	FY 2004 ESTIMATE	FY 2005 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R2455 Vectoring Extremely Short Take-off and Landing (ESTOL) Control Reduced Tail Operation Research (VECTOR)	4,832	4,411	4,122	0	0	0	0	0	9,778

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION The Vectoring ESTOL Control Reduced Tail Operation Research (VECTOR) effort is an international cooperative program with Germany. This task is a follow-on to a previous X-31 thrust vectoring flight demonstration, also with Germany as our partner. That effort utilized engine exhaust thrust vectoring vanes (TVV) to produce thrust vectoring and was limited to medium and high altitude fighter maneuvering. ESTOL and Reduced tail/directional control were not addressed in the previous program. VECTOR rejoins Germany as a partner, who brings vectored thrust, vectored thrust flight control, and Advanced Air Data System (AADS) (flush port) expertise. VECTOR will utilize the X-31 aircraft to develop, flight demonstrate, and provide quality metrics and operational concept formulation and validation of ESTOL and supporting thrust vectoring technologies. The program will also develop an AADS (specifically and uniquely designed to operate even at extreme angles of attack) and will explore reduced vertical tail/directional controls using thrust vectoring with a first-ever fully integrated flight, engine and thrust vectoring control and an AADS. Pay-offs for such technologies and concepts include reductions in requirements for runways for expeditionary operations, reductions of catapult and arresting gear and wind-over-the-deck requirements, decreased aircraft catapult and arresting loads (decreased airframe fatigue), decreased flight controls complexity, lower development and acquisition costs, and decreased aircraft weight, observability, and maintenance costs. Other benefits include significantly higher take-off and lower landing energy (which would reduce aircraft fatigue), and increased safety of flight (due to significantly reduced out-of-control flight incidents). VECTOR results will be applicable to tactical aircraft and unmanned aerial vehicles.

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DATE: February 2000

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603217N

PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology

PROJECT NUMBER: R2455

PROJECT TITLE: Vectoring

ESTOL Control Tailless

Operation Research

(VECTOR)

## 1. (U) FY 1999 ACCOMPLISHMENTS:

- (U) Initiated:
  - (U) Aircraft reactivation.
  - (U) ESTOL concept and requirements definition.
  - (U) Initial ESTOL pilot displays and pilot in-the-loop simulation.
  - (U) ESTOL modeling and simulation.
  - (U) Wind tunnel testing, supporting concept and requirements definition.
  - (U) Update of ESTOL aerodynamics data set.
  - (U) System design for installation and integration of X-31 flight controls, engine controls and thrust vectoring controls.
  - (U) Wind tunnel testing of X-31 integrated systems (in both the U.S. and Germany).
  - (U) Requirements definition for X-31 flight control modifications.
  - (U) Requirements definition and planning for modifications to X-31 thrust vectoring controls.
  - (U) Requirements definition and planning for modifications to X-31 engine controls.
  - (U) Design and fabrication of an Advanced Air Data System (AADS) (flush port).
  - (U) Ground test of an AADS (conducted in Germany).
  - (U) Development of ESTOL and reduced vertical tail/directional stability concepts.
  - (U) ESTOL and reduced vertical tail/directional stability simulation and ground tests, including wind tunnel testing.
  - (U) Flight-hardware-in-the-loop simulation development.
  - (U) Flight control computer reactivation.
  - (U) Initial real-time simulation activation.

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FY 2001 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 2000

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603217N

PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology

PROJECT NUMBER: R2455

PROJECT TITLE: Vectoring

ESTOL Control Tailless

Operation Research

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3. (U) FY 2000 PLAN

- (U) Initiate:
  - (U) Flight control law development
  - (U) Analysis and reporting requirements definition.
  - (U) Analysis and reporting methodologies and systems.
  - (U) Aircraft integration of an Advanced Air Data System (AADS).
  - (U) Design and fabrication of a final design (miniaturized) AADS (flush port).
  - (U) Requirements analysis, design and integration requirements for reduced vertical tail/directional control.
  - (U) Modifications to X-31 flight control software.
  - (U) Modifications to X-31 thrust vectoring controls.
  - (U) Modifications to X-31 engine controls.
  - (U) Advanced ESTOL flight control software (Operational Flight Program (OFP)) development, validation and verification (V&V).
  - (U) Flight development and demonstration of ESTOL technologies.
  - (U) Flight development and demonstration of AADS.
- (U) Continue: (additional work funded in previous years in PE 0603790N):
  - (U) Development and ground test of an AADS.
- (U) Continue:
  - (U) ESTOL and vertical tail/directional control reduction concept and requirements definition.
  - (U) ESTOL and reduced vertical tail/directional control reduction concept simulation and ground tests.

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DATE: February 2000

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603217N

PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology

PROJECT NUMBER: R2455

PROJECT TITLE: Vectoring

ESTOL Control Tailless

Operation Research

(VECTOR)

- (U) ESTOL and reduced vertical tail/directional control concept and requirements definition wind tunnel testing.
- (U) ESTOL modeling and simulation and aerodynamic data set update.
- (U) Requirements definition for X-31 flight control software validation and modification.
- (U) Requirements definition and planning for modifications to X-31 thrust vectoring controls and engine controls.
- (U) System design for installation and integration of X-31 flight controls, engine controls and thrust vectoring controls.
- (U) Flight control law development.
- (U) Extensive wind tunnel testing of X-31 integrated systems (in both the U.S. and Germany).
- (U) Design and fabrication of an Advanced Air Data System (AADS) (flush port).
- (U) Ground test of an AADS (conducted in Germany).
- (U) Flight-hardware-in-the-loop simulation development.
- (U) Complete (additional work funded in previous years in PE 0603790N):
  - (U) Initial design, fabrication and installation of the initial AADS.
  - (U) First AADS development flights.
- (U) Complete:
  - (U) Aircraft reactivation.
  - (U) Reactivation functional check flights.
  - (U) Initial ESTOL cockpit display development.
  - (U) Initial ESTOL development flights.
  - (U) Initial aircraft modifications for thrust vectoring technology development.
  - (U) Initial ESTOL flight software (OFF) development and validation and verification.

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DATE: February 2000

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603217N

PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology

PROJECT NUMBER: R2455

PROJECT TITLE: Vectoring

ESTOL Control Tailless

Operation Research

(VECTOR)

- (U) Flight control computer reactivation.
- (U) Real-time simulation activation.
- (U) Initial ESTOL Aero Data Set.

## 2. FY 2001 PLAN:

- (U) Initiate:
  - (U) Advanced ESTOL flight software (OFP) development, validation and verification
  - (U) Flight demonstration of miniaturized AADS
- (U) Continue:
  - System design installation and integration of X-31 flight controls, engine controls and thrust vectoring controls.
  - (U) Ground and flight test of ESTOL system.
  - (U) Extensive wind tunnel testing of X-31 integrated systems.
  - (U) ESTOL pilot displays and pilot in-the-loop simulation.
  - (U) ESTOL Aero Data Set.
- (U) Continue (additional work funded in previous years in PE 0603790N):
  - (U) Requirements analysis, design and integration of a final design (miniaturized) AADS (flush port).

3. (U) PROGRAM CHANGE SUMMARY: See total program change summary for P.E.

4. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

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FY 2001 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

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BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603217N

PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology

PROJECT NUMBER: R2455

PROJECT TITLE: Vectoring

ESTOL Control Tailless

Operation Research

(VECTOR)

(U) RELATED RDT&E: This program adheres to Defense S&T Reliance Agreements for Air Platforms (Fixed Wing Vehicles).

(U) PE 0601101F (Geophysics)

(U) PE 0601102F (Materials)

(U) PE 0601153N (Defense Research Sciences)

(U) PE 0602122N (Aircraft Technology)

(U) PE 0602201F (Aerospace Flight Dynamics)

(U) PE 0602203F (Aerospace Propulsion)

(U) PE 0602234N (Materials, Electronic and Computer Technology)

(U) PE 0602204F (Aerospace Avionics)

(U) PE 0603112F (Advanced Materials)

(U) PE 0603202F (Aerospace Propulsion Subsystems Integration)

(U) PE 0603205F (Flight Vehicle Technology)

(U) PE 0603211F (Aerospace Structures)

(U) PE 0603216F (Aerospace Propulsion and Power Technology)

(U) PE 0603245F (Advanced Flight Technology Integration)

(U) PE 0603790N (NATO Research and Development)

(U) PE 0603800N & 0603800F (Joint Advanced Strike Technology Program)

3. (U) SCHEDULE PROFILE: Not applicable.

R-1 Line Item 17

Budget Item Justification  
(Exhibit R-2, page 32 of 32)

# UNCLASSIFIED